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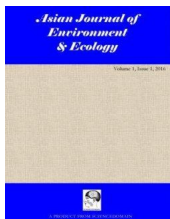
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Causes of Deforestation and Its Geological Impacts in Swat District, Khyber Pakhtunkhwa, Pakistan

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Authors' contributions

This work was carried out in collaboration between all authors. Author MM designed the study and performed the statistical analysis. Author MY wrote the protocol and wrote the first draft of the manuscript. Authors IUD and AB managed the analyses of the study. Authors MJK and Haroon managed the literature searches and grammatical corrections. All authors read and approved the final manuscript.

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ABSTRACT

The most alarming threat to the forest are human being, their actions results transformation of forest lands representing one of the excessive forces in worldwide ecological change and one of the great drivers of biodiversity loss. Human activity is continuous and has a profound impact. Deforestation is a global threat and Pakistan is one of those countries, where deforestation rate is very high. This study was designed in order to find out the causes and impacts of deforestation and forest degradation in District Swat, Khyber Pakhtunkhwa, Pakistan, by incorporating the view of local people through a questionnaire. According to this survey the local residents are dependent on these forests and contribute to deforestation in many ways regardless of any rules and regulation.

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Extensive deforestation in Swat is the result of daily livelihood use of forests furniture, heating, agriculture etc. Unemployment and poverty also plays a key role in forest degradation. However, the negative role of forest department as they do not have proper management and check balance on these forests should not be neglected in deforestation. In the current study the geological impacts like landslides and soil erosion has also been discussed as 78% of the local residents were also aware of the fact that with degradation of forest this hazard increases.

Keywords: Forest; deforestation; causes; hazard; landslides; Swat.

1. INTRODUCTION

Forests are cleared, degraded and fragmented by timber yield, conversion to agriculture, road-building, human-caused fire, and in numerous other ways. Deforestation has important consequences for life on this planet. Deforestation is the transformation of those areas having forests to non-forest land through various anthropogenic activities like cutting, clearing, and removal of rainforest or related ecosystems into less bio-diverse ecosystems such as pasture, cropland, or plantations, urban use etc. [1]. Deforestation is the abstracting of the subsisting natural vegetation cover especially where the native cover is largely forest [2]. Forest degradation or Deforestation is the clearing away of forests in which existing natural forest vegetation and resources of an area are depleted. [3]. Deforestation derives when tree are removed from an area having no reforestation, which directly fallouts in habitat and biodiversity, wood for fuel and industrial use [4]. Throughout the world considerable deforestation is continuing and the global environment and geography are continuously effecting. Forest degradation and deforestation are closely related as both can cause each other [5]. Therefore, in many cases, there is a common cause, immediate or final, for both variables. Since 1850 due to the industrial capitalism the planet has experienced an extraordinary high rate of destruction of forests due to the global extinction of forests [6]. The worldwide the problem of deforestation is alarming not only by the irretrievable loss of this natural wealth, but also that it is a destructive process in which the social and economic gains are smaller as compared to the greater environmental losses.

Deforestation is one of the world's most alarming problems and is growing rapidly. Pakistan is one of those countries where forests are degrading very rapidly, where the main reason is human activities. Among the total square kilometre area (881,913 km²) of Pakistan there is only forests on 16,440 km². In Pakistan forest area is considered

as land under natural or planted stands of trees of at least 5 meters in situ. In Pakistan forest in the mountain area are rapidly degrading especially in the mountain area and the deforestation rate is nearly 1.5% which is very high alarming and threat to ecosystem [7]. In Pakistan fuel wood covers about 53% of total annual domestic energy and is expected to remain high in Pakistan in the future, because Pakistan's economy is not so strong that shift the traditional fuel wood to modern fuels. It is estimated that the population growth and fuel wood consumption will increase by 3% per year. The high demand for domestic fuel wood is supposed to be rapidly diminishing the forests [8].

The big re-entrance such as roads, rivers and railroads, to forests and markets hastens deforestation. Besides this small forest are more accessible than large thick forests and forests in coastal areas and islands are more reachable than others. Forests situated at 2-3 kilometres far from roads are at low risk of deforestation [1]. The deforestation rates may increase because the population is growing and needs more land for food, fuel wood, timber, and agriculture purpose etc. [9]. In the past 300 years, nearly 7-11 million km² of forest has been removed from the surface of earth majorly due to anthropogenic activities [2]. Forests play a key role in the environmental stability. However a number of factors exists which decrease the density of these forests. The current study show that these forests are depleting at very high rate [10]. A number of direct and indirect factors contribute to deforestation in District Swat which comprising alternate resources, unemployment, and lack of education. There is increasing socio-economic concern about the impact of deforestation especially in this 21st century because of the mixed effects; socio-economic benefits and negative effects that it produces. On the positive side, the loss of the world's forest resources has contributed to the fulfilment of households' livelihoods and provided other socio-economic, cultural and spiritual benefits. It is recognised

that nearly 500 million to 1.6 billion people live in and depends on forests profiting partly from the forests for their livings [11]. Global warming, biodiversity loss and soil degradation are the globally long-term environmental consequences and rising problems that has been increasing with increasing deforestation [12] as well as increased poverty in forest fringe communities also aids in forest degradation. Deforestation is a growing challenge for the practice of sustainable forest management, which focuses on balancing environmental benefits and development of livelihoods for the rural poor in order to avoid deforestation [13].

2. MATERIALS AND METHODS

The present study was conducted to assess the knowledge of the local populations of Mingora area (District Swat) in order to find out the cause of deforestation and its geological impressions.

2.1 Study Area

The present study was conducted in Mingora (Latitude $34^{\circ} 46'46''$ and Longitude $72^{\circ} 21'45''$)

area District Swat Khyber Pakhtunkhwa, Pakistan. Mingora is the capital and hub of District Swat (Fig. 1).

2.2 Study Design

A descriptive observational study was design. The local population was interviewed during day time from 9:00 AM to 4:00 PM. All the local residents interrogated during this study were men.

2.3 Data Collection

In order to find out the cause of deforestation in Swat District, Pakistan, for this purpose, mixed qualitative techniques—key informant interviews, focus group discussion, case studies, content analysis from media reporting and a standard questionnaire was used. The survey questionnaire was discussed with the local population in local language (Pashtu) and covered a sample of 200 respondents from Mingora area District Swat where 231,370 is the estimated population.

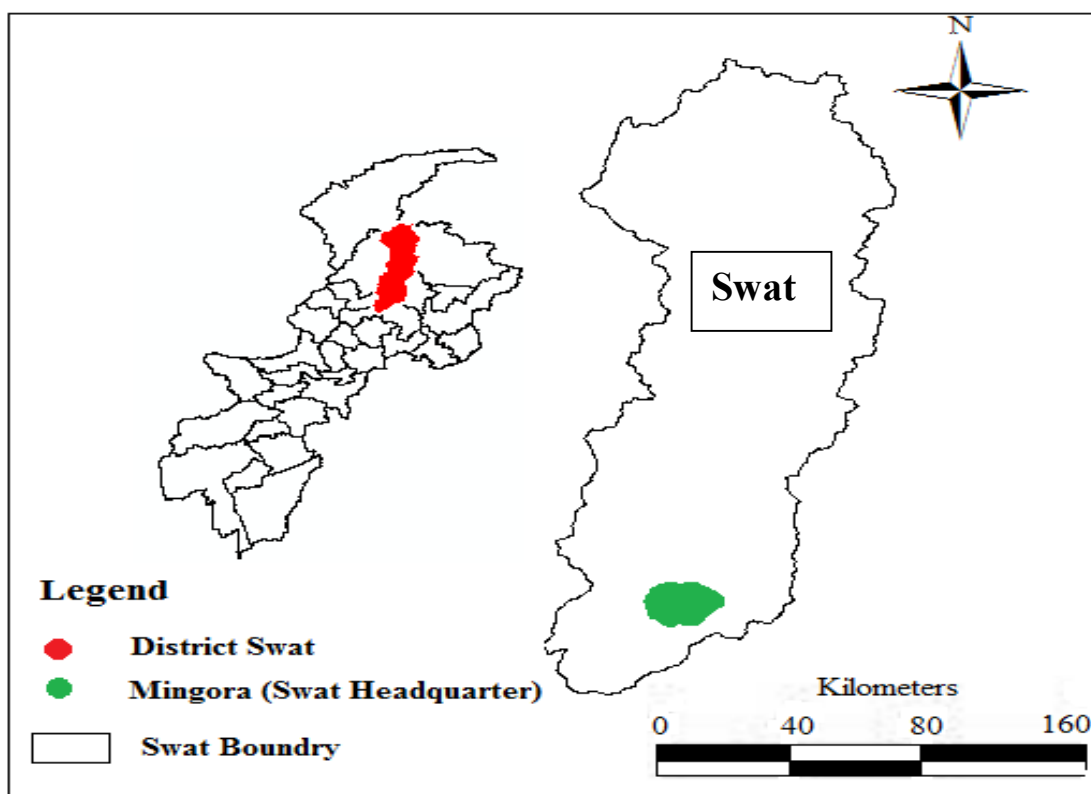


Fig. 1. Map of Mingora, District Swat Khyber Pakhtunkhwa, Pakistan

Data were collected from the Mingora area the centre of district Swat. Two teams composed of geologists and a zoologist have collectively conducted this study. For finding geological impacts of deforestation field visits were carried out in order to collect data and observe the situation visually.

2.4 Data Analysis

The primitive data is statistically evaluated by the Microsoft Excel 2013 for overall results and then results are presented by bar graphs and pie charts.

3. RESULTS AND DISCUSSION

In the current study a total of 200 respondents were interviewed from Mingora area. Fig. 2 shows the occupation of the interviewees, majority of the participants were having their own business 90 (45%) followed by the students 40(35%) and the rest of 70(20%) were farmers.

Majority of the interviewees were being educated people as the Fig. 3 shows 166(83%) of the respondents were educated while the rest 34(17%) were uneducated.

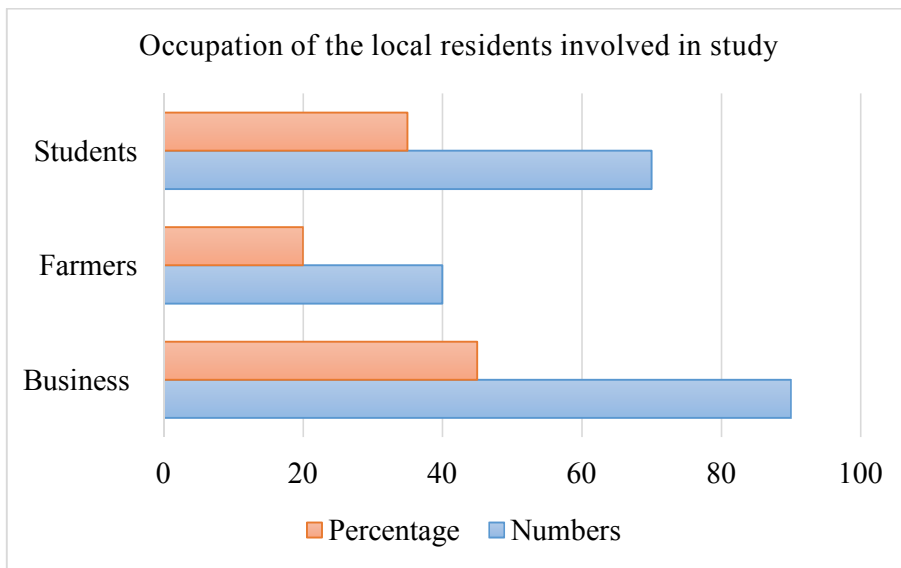


Fig. 2. Occupation of the participants

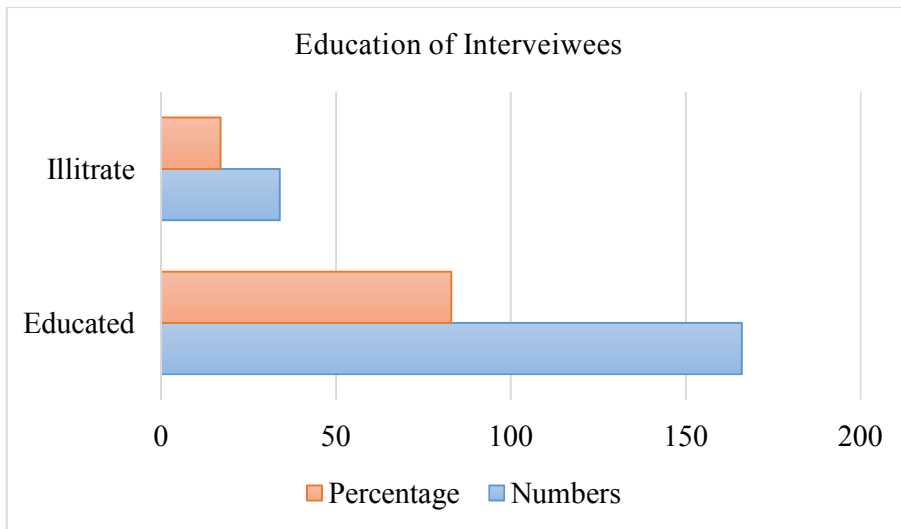


Fig. 3. Ratio of educational status of the participants

Maximum number of respondents were educated and were aware of the results of deforestation while uneducated even don't know the tragic results of deforestation. Lack of alternate resources for fuel wood and timber is the main cause of deforestation in Swat. According to 38% of survey respondents the main cause of deforestation in District Swat is lack of alternate resources in which the main item is fuel wood as shown in Fig. 4. During discussion with the local participants it was find out that most of the people in Swat district use up to 300 mounds of wood for heating and burning in a single year during winter season. 85% of the total needs of people living in the hilly areas or near to forests met from the forests. The remaining 15% needs met from scrub forests (10%), farm lands (2%), LPG/kerosene oil (2%) and from agricultural residues (1%)” [8]. Large amount of fuel wood is used to overcome the requirements, which is a main cause of depletion of these forests. People cut down the trees in excess without any wise management or plantation (afforestation). Globally 70% of total deforestation results from timber consumption and logging activities. Fuel wood collection and to a lesser extent, livestock grazing in forests are the most important drivers of deforestation” [14]. Mostly, where it is possible the local people of Swat use wood in their domestic and commercial activities such as furniture in hotels, shops and homes. They do not use any alternate for timber such as use of plastic commodity instead of wooden furniture. “Another study in northern areas, for the

construction of new and repair of existing houses as was informed by 56% of the respondents the forest wood is intensively using. Most of the houses in all of the villages are made of wood. Even if the house is made of mud/stones or brick yet timber is need for the construction of roofs, doors etc.” [7]. The trend in growing agriculture is also growing up day by day and 34% (Fig. 4) of the interviewers suggest that forest areas are converting to agriculture land causing deforestation.

Another cause of deforestation in District Swat includes unemployment which is given in Fig. 5. Although the literacy rate of Swat is good but still unemployment is a major problem of local people and 35% of the respondents suggest unemployment to be the cause of deforestation. Most of the unemployed and jobless people of the area use these forests as a source of income by illegal manners. “According to the international agencies such as FAO and intergovernmental bodies Poverty and over population are believed to be the main causes of forest loss” [15] and also 34% of local respondent says that over population is also a growing threat to forest. Followed by 31% people say that there is no balance monitoring system and check-up from forest department and thus is also a problem causing deforestation. With increasing population poverty increases, the area is getting more polluted and the natural environment is degrading” [16].

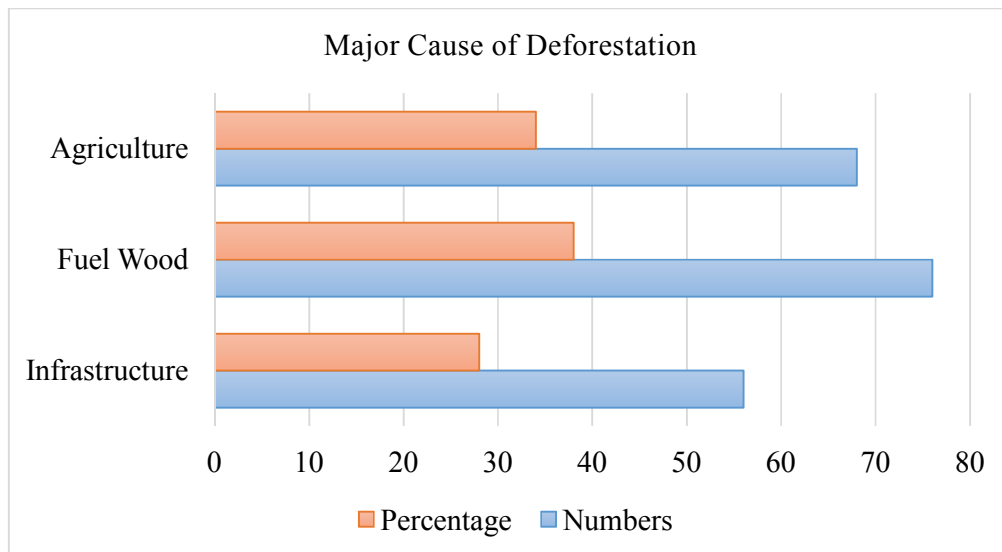


Fig. 4. Direct causes of deforestation

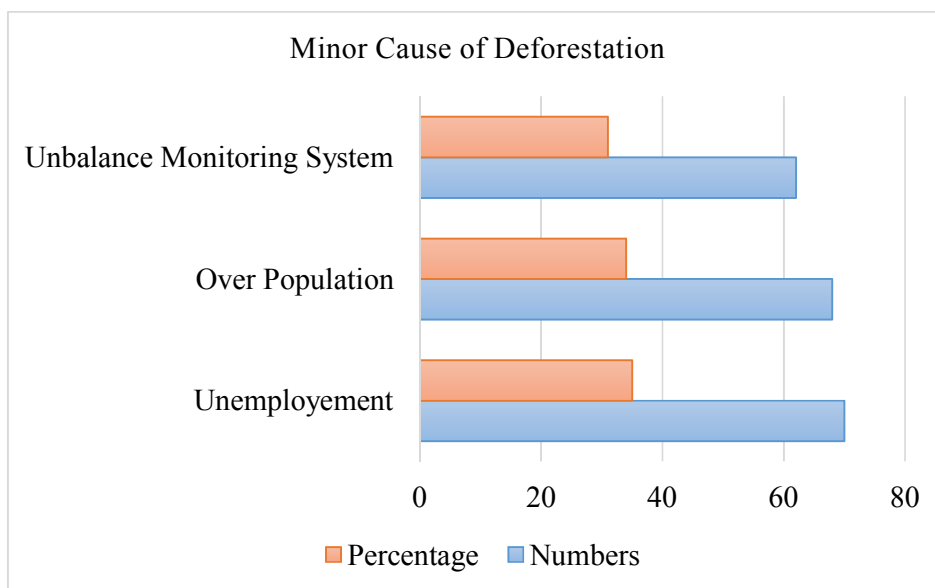


Fig. 5. Minor causes of deforestation

In a discussion and interview from the local resident 90% of peoples says that there is high demand of wooden furniture in the whole district of Swat and the peoples does not have any desire for iron furniture beside 10% response was negative Fig. 6. The demand for wooden furniture directly affects the forest as afforestation is very slow or null.

The local residents were questioned regarding any NGO or governmental project regarding afforestation campaign, the response as shown in Fig. 7 40% peoples says no NGO and government has launched any afforestation campaign while 60% says that recently government has started an afforestation campaign but the deforestation rate is quite rapid as compared to afforestation.

3.1 Extent and Rate of Deforestation

The loss and degradation of forests is evidenced worldwide. In Swat area majority of the respondents (97%) strongly agreed that deforestation is being witnessed in their communities. It is discovered however that the rate of occurrence as supposed by the local people varies greatly. Although there is no doubt about forest cover changes in many humid and sub-humid tropical areas, there remains much debate on the rate and extent of deforestation. From Table 1, 144 respondents (72%) identified the rate of deforestation to be rapid. 16 respondents (8%) also indicated that the rate of

deforestation is slow; while 40 respondents (20%) indicated it being moderate. To authorise the statement that deforestation has been rapid, some respondents explained how settlement expansion and agricultural cultivation have caused retreat of forests from the residences and community centres over the years. Some suggest that the use of land for growing crop/agriculture also pushes the forest into decreasing number.

Table 1. Rate of deforestation

Rate of deforestation	Frequency	Percent
Rapid	144	72
Slow	16	8
Moderate	40	20
Total	200	100

Source: Author field visit (2016)

3.2 Daily Livelihood Activities Causing Deforestation

Daily life activities also play a key role in forest degradation. About 90% of the interviewees confirmed that the process of deforestation results directly and indirectly from livelihood activities of the local people. In this study different livelihood activities were noted and these are also highlighted to produce varied impacts. The frequency of deforestation has been shown in Table 2, 86 respondents (43%) indicated that use of wood as fuel exists among the top factor resulting in deforestation. This is followed by 70 respondents (35%) who named

agriculture, and 60 respondents (30) suggested that chainsaw operation is also among the daily life activities resulting and causing deforestation. It is observed from Table 2 that, deforestation is mostly caused by use of wood as fuel and agriculture though the impacts from the other activities are recognizable. Some interviewers suggested that chainsaw operation destroyed forests much more than other livelihood activities because it occurs deep in the core of the forests as compared with the other livelihood activities which are most often carried out on the fringes of the forests. Quite apart from that, the felling of trees by chainsaw operators is disputed to be

carried out indiscriminately. As a result of this, they hardly consider if a tree is harvestable or not.

Table 2. Daily livelihood activities causing deforestation

Daily livelihood activities	Frequency	Percent
Agriculture	70	35
Fuel wood	86	43
Chainsaw operation	60	30
Total	200	100

Source: Author field work (2016)

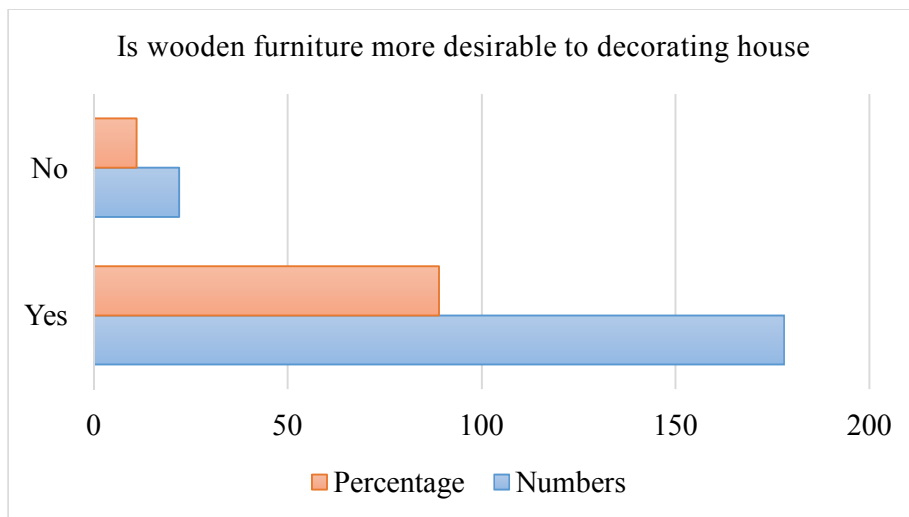


Fig. 6. Demand of wooden furniture

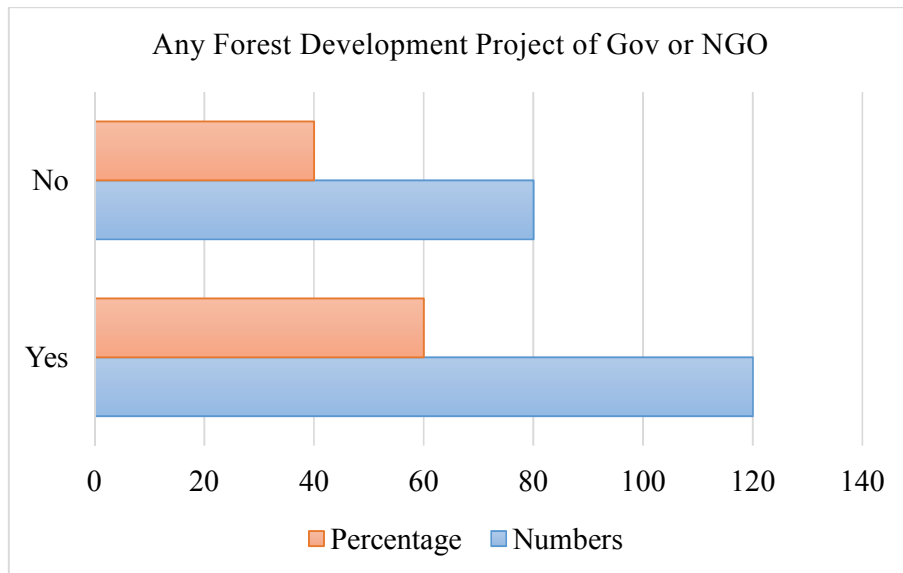


Fig. 7. Govt or NGO Campaign for afforestation

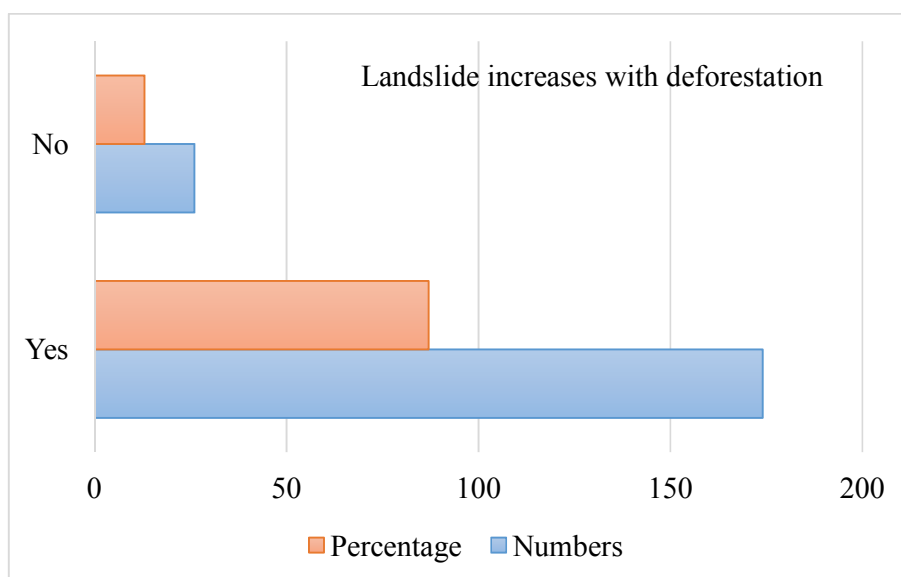


Fig. 8. Landslide increases with deforestation (Response of local residents)

3.3 Geological Impacts of Deforestation

3.3.1 Landslides

District Swat is very prone to natural hazards as geologically it is an active tectonic zone. Landslide is also one of the natural hazards, in hilly areas like Swat the forests or plant roots holds the soil/rock strata firmly so that no downward motion of rocks or soil occurs. Beside when plants are degraded from an area the chances of landslide increases as nothing will then holds the soil/rocks and downward movement of rock or soil as landslide occurs. The local residents were asked about deforestation and landslides the response as shown in Fig. 8, 78% of the people were quite clear of the fact that landslide problem increase with the removal of plants (Forests) followed by 13% response as negative.

3.3.2 Forest and soil erosion and sedimentation

The relationship between deforestation and soil erosion is difficult to measure since the magnitude of erosion depends, among other things, on land-use practice, soil management, location and annual rainfall. Nevertheless, soil erosion is higher in areas with little or no vegetative cover. In addition, the importance of nitrate as a potential agent appears relatively low in undisturbed forests because nitrifying bacteria function poorly in acid soils, with the soil

becoming even more acid as the forest matures. However, when forests are cut and the inhibition mechanisms destroyed, nitrates become relatively important in leaching processes [15,1].

4. CONCLUSION

From the current study it was concluded that the deforestation is growing rapidly and the major reasons of forest degradation includes daily use of wood as fuel, use of wood as furniture. No proper monitoring system in the area also ensure illegal cutting of forests. The use of land for agriculture purpose also leads to the forest degradation while landslide and soil erosion are the main geological problem increasing directly with plants removal and especially in Swat District.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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